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EDITORIAL COMMENT

# Is Pulmonary Vein Antrum Isolation a Critical Determinant of Recurrent Arrhythmias After Ablation of Atrial Fibrillation?*

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In this issue of the *Journal*, Di Biase et al. (1) reported their initial experience with remote magnetic navigation of a 4-mm-tip catheter for ablation of atrial fibrillation (AF). Their results confirm that the catheter navigated to targets and reduced fluoroscopy; however, the procedure time was not improved and the 4-mm-tip catheter was ineffective and prone to charring. This is why most groups have abandoned 4-mm-tip catheters for ablation of AF. Experience with remote navigation is required to assess tissue contact, but the incidence of charring reported by Di Biase et al. (1)

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suggests that poor contact did not account for failed pulmonary vein antrum isolation (PVAI). Their observations are consistent with the experience at Washington University, which has been involved with the development of this technology from its inception (2–4). Specifically, we have found that the system meets expectations for navigation to left atrial targets as reported by Di Biase et al. (1) and Pappone et al. (5); however, I share the opinion that the 4-mm-tip catheter, which was designed for ablation of supraventricular tachycardia, should not be promoted for ablation of AF. An irrigated magnetic navigation catheter, which is under development, should improve delivery of energy and reduce or eliminate char formation.

This paper is unique because the authors prospectively tested the hypothesis that PVAI determines recurrence of AF. They reported 78% of patients were free of recurrence of AF when PVAI was achieved for all four pulmonary veins, whereas the success rate was only 10% when PVAI was incomplete despite wide circumferential ablation. This is concordant with other studies which have demonstrated that recovery of pulmonary vein conduction is associated with recurrence of atrial arrhythmias (6–9). These studies focused on patients with recurrent symptoms. An important question is how often does pulmonary vein conduction recover in patients without recurrence of atrial fibrillation? Cappato et al. (10) examined this in patients who had undergone a second electrophysiology study after segmental pulmonary vein isolation for paroxysmal or persistent AF. They found that recovery of conduction was associated with recurrence of AF, but a clinically successful outcome was achieved in 32% of patients despite late recurrence of conduction. In such patients, absence of symptomatic AF may have been related to ablation of triggers or slower conduction across the ablated segments that had recovered.

Methods for ablation of AF have evolved from elimination of triggers, to segmental pulmonary vein isolation, to wide circumferential ablation incorporating a larger mass of atrial tissue (11–13). The evolution of ablation techniques recognizes that triggered mechanisms alone may account for AF in some patients, but in most there is a need to modify the substrate that sustains AF. In this regard, there is not much difference between PVAI and wide circumferential ablation. Both approaches include the antrum and a large portion of the posterior wall of the left atrium. Ablation of complex fractionated electrograms is another method (14). Each approach substantially modifies the substrate that sustains AF. These methods are supported by investigations showing that the ability to sustain AF depends on left atrial mass and refractoriness (15), local atrial frequency (16–18), and wavebreak and re-entry on the posterior wall (19).

The effect of extensive wide circumferential ablation should be comparable to PVAI if meticulous care is taken to ablate all tissue within the circumferential lesions, because both methods encompass a similar mass of atrial tissue. It is certainly possible that during wide circumferential ablation either the pulmonary vein antrum would be isolated, or conduction through this zone would be altered so profoundly that atrial fibrillation could not be sustained. However, Hocini et al. (20) found that voltage reduction within wide circumferential ablation does not consistently predict isolation of the pulmonary veins. The central question is what end point should be used to judge the success of the procedure? Is voltage reduction without PVAI sufficient? The study by Di Biase et al. (1) demonstrates that when PVAI is the standard, complete isolation of the pulmonary vein antrum portends a modest risk of AF but that recurrence rates are very high when this end point is not achieved.

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